What is the Best Way to Determine Your Cleaning Costs?

The most effective and common cleaning chemistries utilize two methods of removing contaminants: emulsifying and displacement.

- With an emulsifying cleaner, oily soils are held or encapsulated at the operating temperature. When cooled, some of these oils may be released.
- A displacement-type cleaner displaces oils from the substrate surface.

Since most oily soils are less dense than water, they will float on the bath surface. With either cleaner, released oily soils can be removed by mechanical devices and filters. Contaminants are also removed by regularly removing these soils, minimizing their effect relative to aging the cleaner bath. Specifically, the service life of the cleaner is extended, resulting in genuine and repeatable cost savings. It's a win-win - maintaining a higher cleaning efficiency while being a more economical alternative.

But does displacement cleaning offer an advantage to emulsifying cleaning or vice versa? Let's find out.

There are three types of cleaners to work with: powder, liquid, and additives.

1. Powder cleaners have been a staple of the industry for decades. They continue to be heavily used and offer various dependable formulations, tackling all cleaning demands.
2. Liquid cleaners are formulated as equivalent to powders, though they also offer certain additional benefits such as:
   a. significantly less sludging (a plus when considering F-008 regulations and the cost to ship sludge)
   b. easier and safer makeup
      i. Concentrate is assured of being 100% blended throughout
      ii. can be metered and continually analyzed by conductivity measurement (SPC and NADCAP benefits)
   c. for larger volume users, liquid cleaners may be supplied in returnable totes, eliminating the disposal of empty drums
3. Additives, in combination with generic liquid caustic soda (usually 50% strength), are primarily used to clean steel.
   a. An additive concentrate (typically liquid) is added in a specific ratio with liquid caustic soda in the soak cleaner and a different ratio for both in the electro cleaner.

Dual-functioning Cleaners

In some instances, there is reason to consider branching off the traditional stand-alone soak and electro cleaners and opt for a dual-functioning cleaner: A combination soak and electro cleaner in one tank or in separate process tanks where a rinse in between can be eliminated.

Benefits include:

- Simplifying inventory
- Omitting a rinse (and thereby conserving water)
- Doubling the function of a single process tank (saving on heating and maintenance)
- Use of generic liquid caustic soda reduces chemical costs overall.

Analytical Control

As it applies to cleaning methodologies, analytical control cannot be overemphasized.

The most common analysis has been neutralization titration with a standard acid solution to an indicator-induced solution color change. Frankly, this method is hard to improve on, as most cleaners contain complex wetter and surfactant systems.

Complex analysis procedures (yes, multiple procedures) to analyze each wetter / surfactant component are extremely difficult to execute. Even university chemistry staff, armed with specialized instruments and elegant techniques, would find them challenging. Beyond the cost of maintaining in-house staff and equipment, complexity is compounded by trying to accurately determine which wetter / surfactant to add and how much.

Relatively speaking, the cost of the cleaner is quite inexpensive, and the simple neutralization titration efficiently corrects for satisfactory cleaning results. Keep it simple and effective, relying with confidence on the neutralization titration.

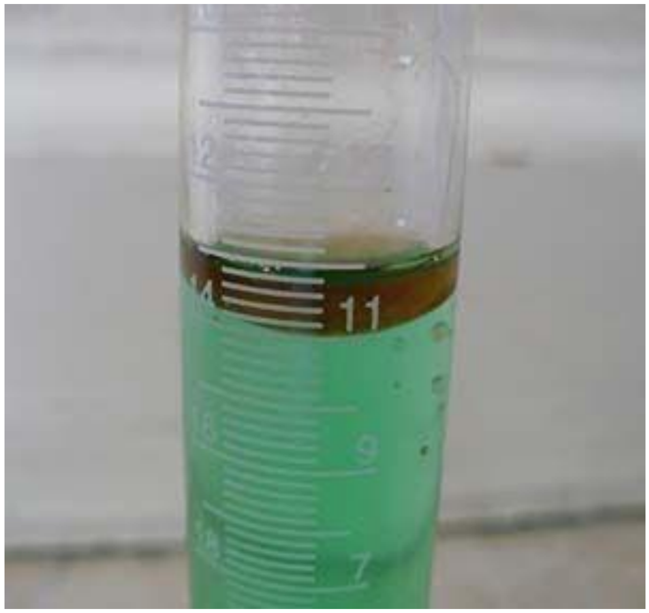
The operation continues with cleaner-bath analysis by titration (or test kit), maintenance adds and rolling along until dump time.

Should the operator be required to dump the cleaner after a determined quantity of cleaner has already been added? This reminds us that the general schedule for dumping after the maintenance additions is 2X the initial make-up quantity. Are we confident the cleaner bath is actually “shot?” What if it has 25% or some other viable percentage of service life left? This is where some simple, additional analysis can help better determine the actual dump cycle.

Two suggestions:

1. Fill a graduated cylinder with the heated cleaner. Let it cool. Measure how much oil has split. Carefully track a new bath make-up. Note the oil displacement when the cleaner is dumped. Repeat this for the next cleaner bath and keep operating past the oil split level for the previously dumped cleaner. Meanwhile, continuously analyze by titration for the product, making required additions. Coinciding with analysis, perform the oil split determination. You may find that the cleaner has been dumped too soon.

Displaced Oil Cleaner Test



2. Immerse a clean steel panel in a cleaner sample at operating temperature, time, and concentration. Rinse and observe for any water breaks on the panel. Add 10-20% of initial makeup to the sample if there are water breaks. Repeat the cleaning step and water-break test on a new panel. If there's no water break, dip the rinsed panel in dilute acid (ex. 5% hydrochloric or sulfuric), then rinse again. If a water break is evident, repeat the suggested addition of cleaner and the sequence of rinse and acid dip, followed by rinse. If these steps confirm no water breaks, the cleaner can be expected to continue production operations. The optional cleaner addition is made per the results of the described test.

Water Break Condition Requires Addition of Cleaner

Bottom-line Results

Such analysis can be invaluable to ensuring satisfactory cleaning, equipping operators with additional valuable data to better determine dump cycles. To recap, the ability to extend the bath service life reduces costs in several significant ways: Beyond reducing downtime, consuming less cleaning product, and easing demand on waste-treatment systems, better ongoing cleaning results in fewer rejects that would have to be scrapped or re-worked.

Calculating Costs: A Practical Equation

What follows is a method of calculating your operation's cleaning costs, which can be derived from the following equation:

$$C = S/PD + M/PD + R/P + W/PD$$

Key:

C = production standard. Ex: cost to clean 1,000 ft2 of parts.
S = the cost of chemicals, including makeup and maintenance.
M = the cost of dumping a cleaner and replacing it with a new make-up.
R = the cost to re-work rejects or scrap parts.
W = the cost of waste treatment for the dumped cleaner.
P = daily production of parts in units (ft2, etc.)
D = # of working days the cleaner is used in production during its service life.

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